(12) UK Patent Application (19) GB (11) 2 180 450 (13) A

(43) Application published 1 Apr 1987

(21) Application No 8622764

(22) Date of filing 22 Sep 1986

(30) Priority data

(31) 8523316 (32) 20 Sep 1985 (33) GB

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(51) INT CL[4]
A41G 1/00

(52) Domestic classification (Edition I)
A4X 15

(56) Documents cited

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GB	1575012	GB	0244310
GB	1113171	EP A2	0093251
GB	0988670	US	3861991
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GB	0621543	US	3556916
GB	0516442		

(58) Field of search
A4X
Selected US specifications from IPC sub-class A41G

(54) Artificial plants

(57) Artificial plant comprises a stem 1 connected to one or more leaves 3 and/or petals 2 has exterior surface part(s) 4 in communication or direct contact with means for supplying odoriferous substance in any required physical state and optionally inactive until subsequently activated by fluid, the substance either releasing a desirable or useful odour or capable of subsequent release at the exterior surface part. Encapsulated substance may be employed or a separate reservoir containing the fragrance or activating fluid as described. The stem and/or its interior may communicate the substance through a variety of capillary or absorbent substrates to achieve required flow and output.

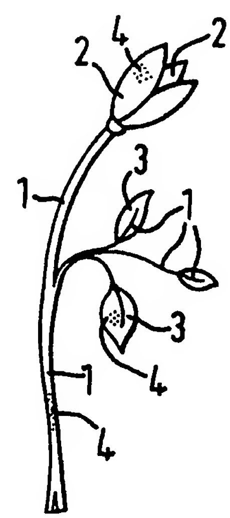

FIG. 1

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1982.

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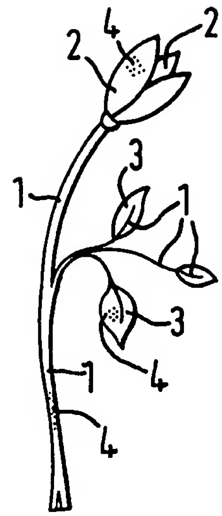

FIG. 1

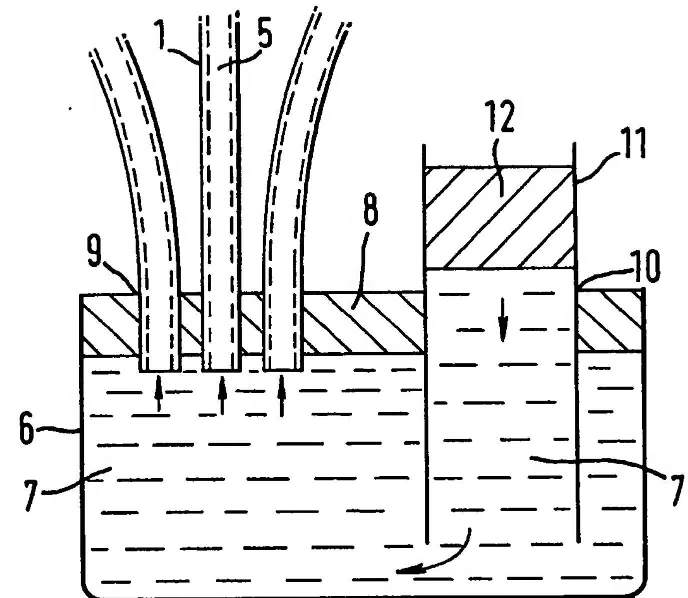

FIG. 4

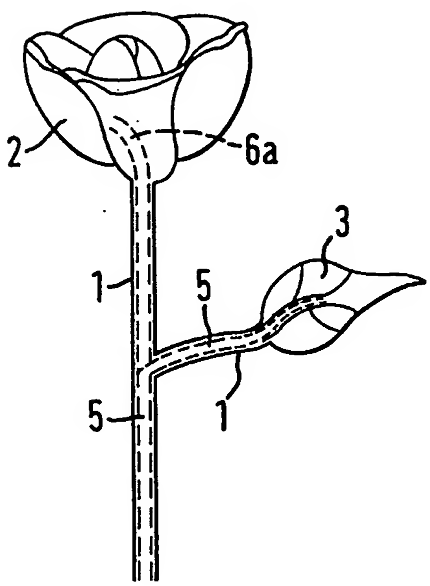

FIG. 2

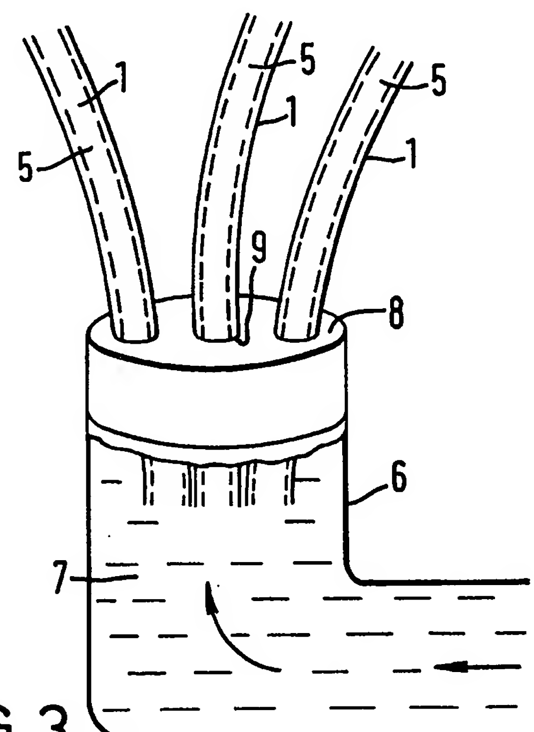

FIG. 3

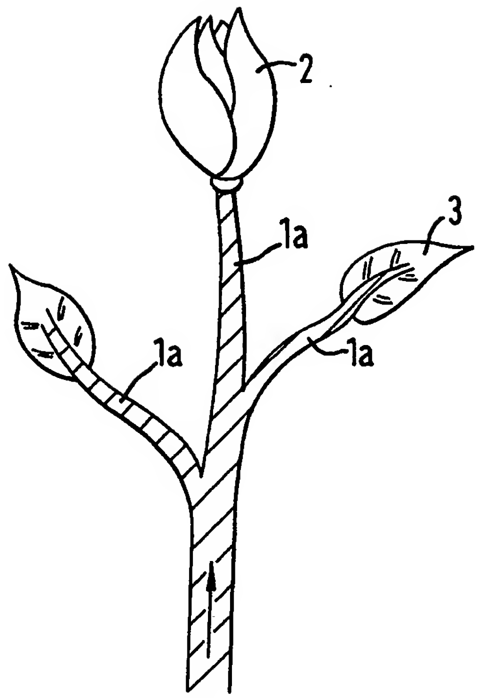

FIG.5

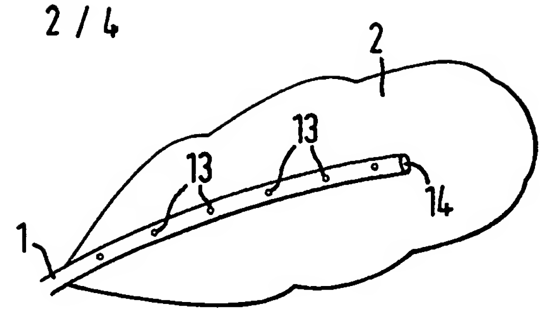

FIG.7

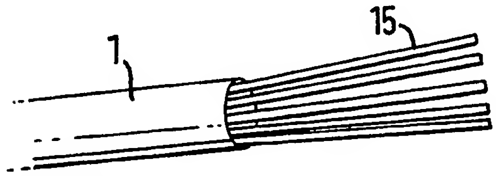

FIG.8

FIG.9

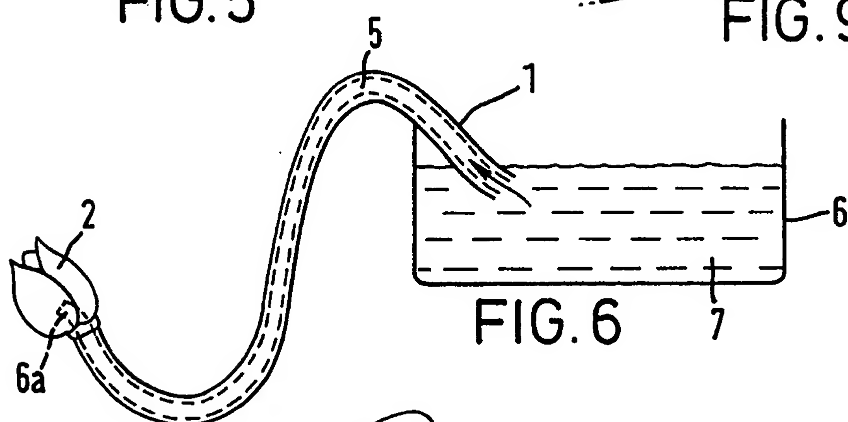

FIG.6

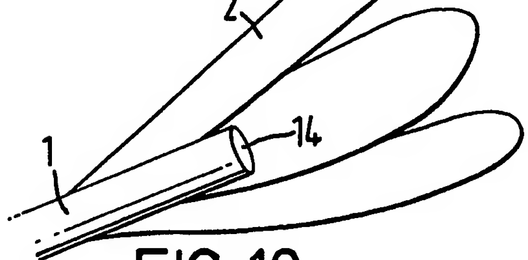

FIG.10

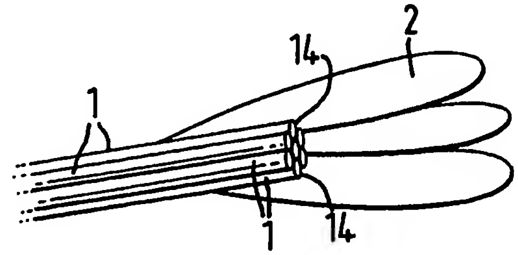

FIG.11

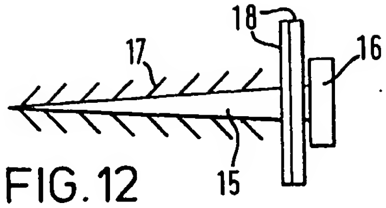

FIG. 12

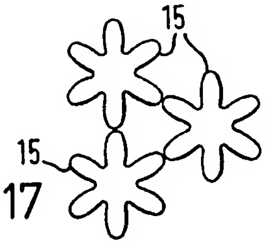

FIG. 17

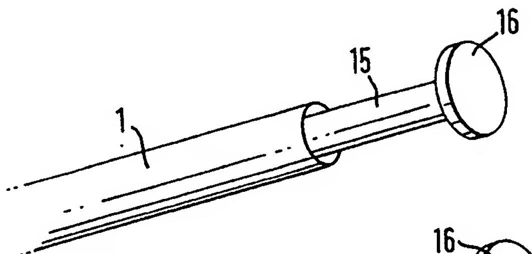

FIG. 13

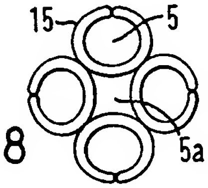

FIG. 18

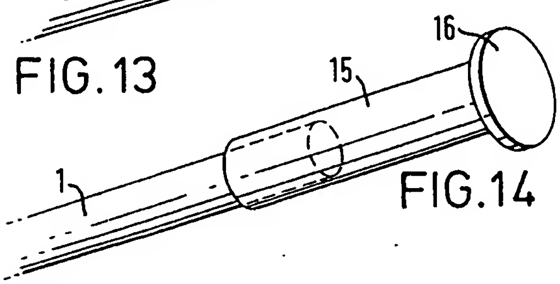

FIG. 14

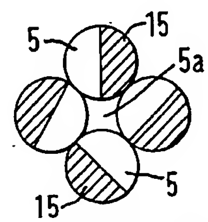

FIG. 19

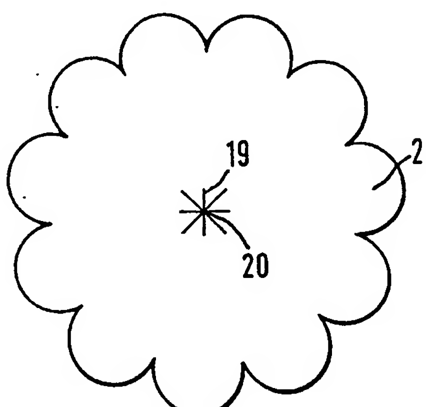

FIG. 15

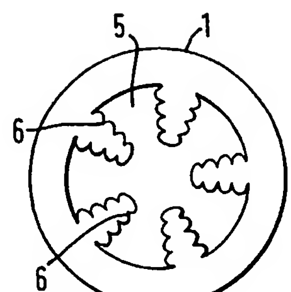

FIG. 20

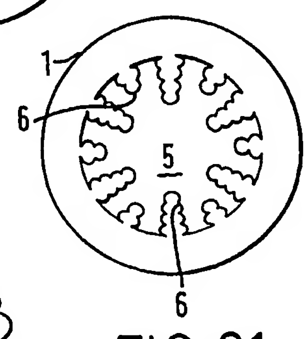

FIG. 21

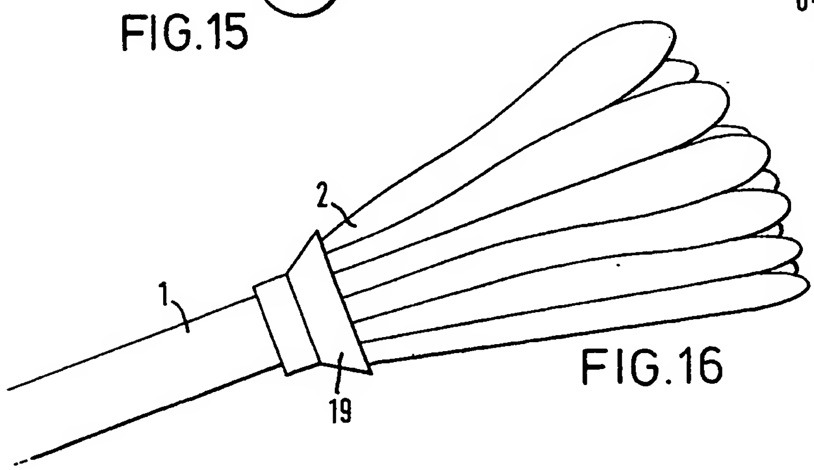

FIG. 16

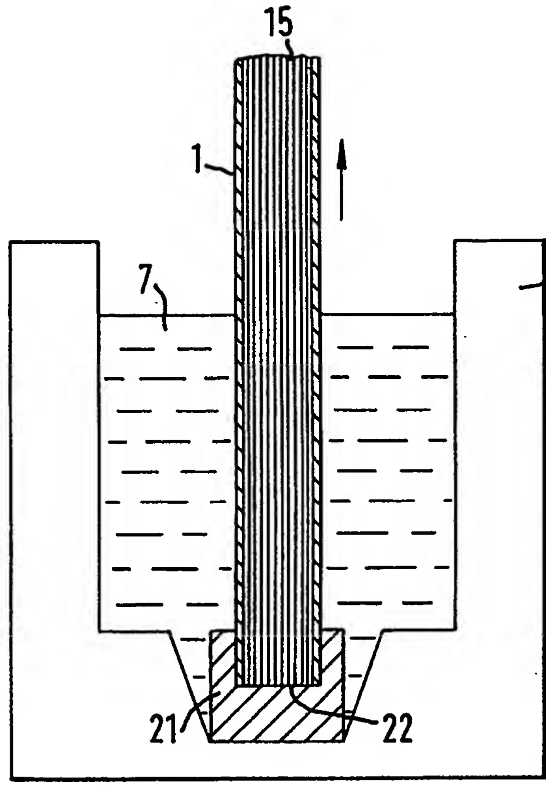

FIG. 22

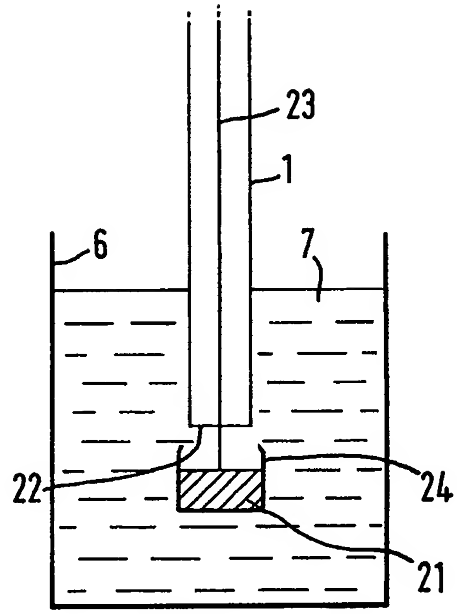

FIG. 23

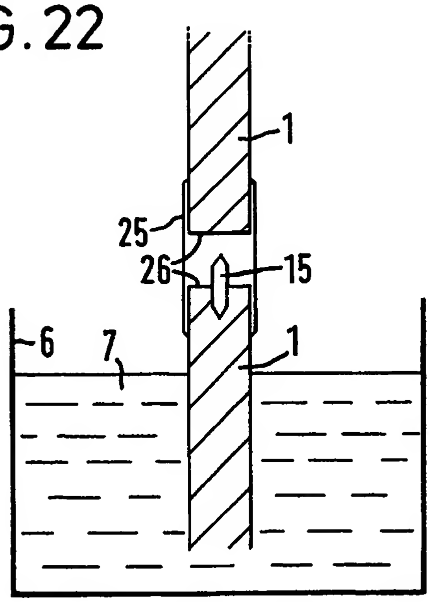

FIG. 24

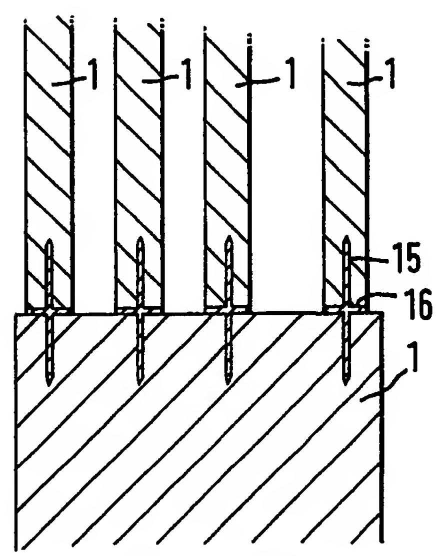

FIG. 25

SPECIFICATION
Improvements in Artificial Plants

This invention is concerned with improvements in artificial plants including flowers, and more particularly with imparting desirable or useful odours, e.g. fragrance to artificial plants. This invention may also serve to impart odoriferous medicaments, insect repellants, insect attractants, pheromones, insecticides, anti-fungal agents, anti-bacterial agents, or other liquids and vapours. The term "odoriferous substance" is used to embrace all the aforesaid materials, and is used preferably to denote a desirable perfume or fragrance in any physical state.

Artificial plants are well known substitutes for real ones and they can be kept for a considerable time, but have no fragrance. It is from a consideration of this drawback that has led to the present invention.

The invention is based on imparting, e.g. a fragrance to an artificial plant, e.g. an artificial flower, wherein the fragrance is (A) applied in liquid, solid or even vapour form, such as a powder, directly to one or more specific stem, leaf, flower or petal regions collectively referred to as 'emanators' as a liquid or solid and/or in encapsulated form capable of subsequent fragrance release, and/or (B) supplied in liquid or vapour form by the stem from a reservoir spaced from the leaves or petals to reach one or more leaves and/or petals, and/or where fluid from the reservoir activates or catalyses initially inert fragrances previously applied at required location(s).

If solid fragrance is employed it may be of the type which is inert in the dry state but subsequently activated by applying a liquid, for example water, which may give the desirable impression of watering genuine plants.

The invention further embraces (i) an artificial plant wherein free liquid or solid fragrance has been applied directly to one or more specific stem, leaf or flower regions, (ii) an artificial plant wherein liquid or solid fragrance in encapsulated form has been applied to one or more specific stem, leaf or petal regions, and (iii) the combination of an artificial plant with a fluid reservoir remote from the leaves or petals and wherein the stem is constructed or otherwise adapted to transfer fragrance or liquid, etc. from the reservoir to one or more leaves and/or petals either by using the interior of the stem, the exterior of the stem, or internal and/or external stem transference.

According to this invention there is provided an artificial plant comprising a stem connected to one or more leaves and/or petals and having an exterior surface part in communication or direct contact with means for supplying liquid, solid or gaseous odoriferous substance which can release its odour at the said part.

Basically, therefore, odoriferous substance preferably as a fragrance is applied to the exterior surface of one or more of the stem, petals, flower buds or transported to or via the stem, petals, flower buds, etc. These direct and indirect routes may be used in combination, e.g. solvent is transported to a location of solid fragrance causing it to release its pleasant odour.

Such artificial plants may then be used in conjunction with real flowers, to help accentuate the smell of the real flowers, either by emanating similar or supplementary fragrance.

The stem may be made from a liquid-absorbent material or it may carry liquid-absorbent material on its exterior surface.

Alternatively or additionally the stem may be hollow with or without tube(s) therein and means can be provided to cause liquid fragrance to be transferred from the reservoir along the stem. In place of the stem having a single hollow tube the stem may be provided with one or several tubes or capillaries: The stem may be hollow and comprise a wick of absorbent material along which liquid, e.g. odoriferous substance or activating liquid may flow.

The junction between stem and leaf or stem and petal may comprise liquid-absorbent material, which said material may furthermore if required be in contact with any liquid-absorbent material on the stem (if such is present) or, alternatively, in contact with a liquid-absorbent stem (if such is present).

The word "stem" is used herein to include not only the principal stem to the main flower(s) on the plant but also all lengths of supportive material in the artificial plants such as the main stem, the stem from which a leaf extends and the individual central portion within a leaf or petal providing support.

"Stem" is further used to include any item lending physical support, and/or providing a structure for the transfer of liquid/vapour and/or providing a structure for deposition of solid or encapsulated material and/or describing a structure transporting or capable of transporting liquid or vapour. The word stem includes root, the connector between a leaf and flower bud and/or petal, the primary vein(s) in a leaf or petal and the centre of a flower bud.

"Liquid" is used to embrace solvent, fragrance, insecticide, anti-bacterial agent, anti-fungal agent, pheromone or solvent containing pheromone, insect attractants, odoriferous medicaments etc., or a mixture of any of these provided in a liquid physical state. With particular reference the words fragrance and perfume the term "liquid" is sometimes used to denote either for convenience. "Fluid" embraces both liquid and gaseous media.

The terms "leaves", "petals", "flower buds" are used to embrace not only their common description of various flower parts but all and any protrusions, additions to and subtractions from the basic shape of the stem(s).

As will become apparent from the following description of embodiments, the present invention

includes within its scope methods of imparting odoriferous substance to an artificial plant and artificial plants constructed on the basis of these methods to impart fragrance. Briefly summarized, the techniques include impregnation, encapsulation, use of a hollow stem or a stem comprising tube(s), fibres, or other material for fluid transport in any direction, and (iv) use of a stem whose exterior is adapted to facilitate travel, in any direction, of liquid whereby the stem is used to communicate fluid from a reservoir to one or more leaves and/or petals.

In order that the invention may be illustrated and readily carried into effect, non-limiting embodiments and examples thereof will now be described with reference to the accompanying drawings by way of example only and wherein:

Figure 1 shows an artificial flower based on impregnation and/or encapsulation techniques,

Figure 2 shows an artificial flower arrangement wherein the stem interior is used to effect fragrance transfer,

Figure 3 shows a detail of one form of reservoir communicating with a plurality of stems,

Figure 4 shows an alternative form of reservoir including different means to effect liquid/fragrance movement,

Figure 5 shows an artificial flower wherein the stem has been modified to effect liquid/fragrance transfer,

Figure 6 illustrates an artificial flower arrangement relying on gravity for liquid/fragrance transfer,

Figure 7 shows a multiple apertured stem and leaf,

Figures 8 and 9 show arrangements of fibres in and on the stem,

Figures 10 and 11 respectively show single and multiple fine bore tubes,

Figure 12 illustrates a fibrous plug in the form of a nail,

Figures 13 and 14 show a fibrous plug secured within or around a stem,

Figure 15 shows a petal adapted to be carried by a fibrous plug,

Figure 16 shows flower petals secured to a stem,

Figures 17 and 19 show modified or alternative stems, tubes or fibres in cross-section, and

Figures 20 and 21 show modified or alternative single tubes or stems in cross-section.

Referring firstly to Figure 1, an artificial flower comprises a stem 1, which is taken to include the main stem portion terminating at the flower head and the portions which carry leaves, and furthermore the portions from which the leaves and petals themselves extend. The leaves 3 and petals 2 are made of any suitable absorbent material preferably, although non-absorbent material may be effective. Specific exterior surface parts 4 of the stem or leaf or petal have received a liquid fragrance. The liquid fragrance has been applied directly to the inside or outside of a petal, the underside or topside of a leaf and/or on the surface of the stem or supporting material. The regions may be, for example, soaked in the fragrance or it may be applied by spraying. The fragrance could be applied by pressing or if the portions are printed at the same time as colour printing by using, e.g. fragranced ink. Such method and flower arrangement may not be preferred because the major proportion of fragrance may evaporate quickly and fragrance output can then significantly decrease.

In an alternative but similar method which is not shown in Figure 1, the fragrance is applied in encapsulated form. Discrete capsules or microcapsules of fragrance may be secured to any required portion of the artificial flower. Fragrance can then be released by causing the encapsulation to break, e.g. by squeezing, pressing, rubbing or using a peel-off strip format. Alternatively, the fragrance may be encouraged to be expelled by shaking, rubbing or scratching the capsules, or by general decay of encapsulation material.

Referring next to Figure 2, an artificial flower arrangement is shown which utilizes the stem for effecting transfer of liquid. This drawing may be considered with reference also to Figures 3 and 4 which illustrate reservoirs which may be attached to the form of flower shown in Figure 2. The stem in this arrangement 1 comprises a hollow bore 5 which terminates at a transfer junction allowing the liquid fragrance to flow onto the petals 2. The transfer junction may comprise an absorbent material to assist fragrance dispersion. Although a single hollow interior bore 5 is shown this may be replaced with one or more capillaries or a hollow bore tube which has an increased surface area or fibres, or mixtures of one or more thereof. The capillaries, if used, may be sufficiently fine to enable fragrance or other liquid to flow by capillary action. The material of the petals 2 or leaves 3 may be absorbent and so assist the transfer mechanism.

This tube could also contain a form of "wick" of absorbent material or other material to facilitate fluid motion by absorbtion or osmosis. This material could consist of a natural or synthetic open celled foam, e.g. a phenol formaldehyde foam.

As shown in Figures 3 and 4, examples of liquid reservoir are shown. The reservoir 6 in Figure 3 may, for example, be pressurized or, alternatively, the exterior walls of the reservoir 6 containing fragrance or activating liquid 7 may be constructed so as to tend to contract. A seal 8 is provided at the mouth of the reservoir in which three apertures 9 are provided and wherein a corresponding number of stems 1 are inserted with their lower-most ends contacting the liquid 7. The stems 1 as shown comprise a hollow bore 5 which may or may not have a separate tube located therein. Alternatively or additionally, the bore of each stem may have a number of fine capillaries.

Referring to Figure 4, a reservoir containing liquid 7 and a seal 8 is provided, the seal additionally having a plunger mechanism 11 wherein a flush plunger 12 exerts a force on the liquid 7 therein by gravity.

The plunger arrangement 11 is a tight fit within an aperture 10 in the seal 8. The rate of liquid transfer may be varied according to the mass of the flush plunger and depending upon whether additional manual force is applied thereto.

This reservoir could contain activating fluid such as an inorganic and/or organic solvent which would flow through the tube, capillary or wicking to "flush out" a fragrance which has already been placed in the stem of the artificial flower or to activate initially inert fragrance on any exterior part of the plant.

In the arrangements of Figures 2 to 4 the stem may be provided with exits (see Figure 7) through which the activating liquid or fragrance 7 may be discharged and, if desired, subsequently absorbed across to the petals and/or leaves and/or other exterior surface parts of the artificial flower.

The modification of Figure 5 is that the stem has an exterior 1a constructed of a liquid-absorbent material. The petals 2 and leaves 3 may be of an absorbent material to aid transfer of activating liquid or fragrance. Thus, liquid may be transferred from the base of the stem, from e.g. a reservoir (not shown) along the exterior surface of the stem to the locations required. The absorbent material 1a on the exterior of the stem may be permanently affixed to the flower whereby liquid may be transferred from the stem(s) to either other absorbent material which has been subsequently added to the petals or leaves or, alternatively, directly onto the petals and leaves constructed of absorbent material.

Referring to Figure 5, a further modification is to construct the stem(s) 1a mainly or solely of absorbent material. Transfer of liquid from a reservoir (not shown) may occur in similar fashion.

Referring to Figure 6, a method of conferring fragrance to an artificial flower is shown by use of gravity feed. A reservoir 6 containing, e.g. activating liquid or fragrance 7, is provided in communication with a stem 1 having a hollow bore 5 terminating at transfer junction 6a where discharge of the liquid 7 onto petals 2 occurs. Alternatively, the stem may comprise one or more capillaries. The transfer junction 6a is situated below the level of the liquid in the reservoir whereby gravity feeds liquid onto the petals.

Further preferred or optional features are now described, not all of which have been illustrated.

Where the liquid is transferred up the or down the stem there are a number of optionally preferred transfer media or substrates.

Glass capillary tubes may be used, as may glass fibres. Glass has the advantage of being very resistant and absorption is less likely to occur. Tubes of regular diameter have the advantage of yielding repeatable, controlled rates of release. Other media include microtubes of polyethylene terephthalate, polyesters, polyolefin, acrylics, polyamides, organo polysiloxanes.

Additives to enhance capillary action such as surfactants and heat stabilizers in the liquid may be used where appropriate.

Figure 7 shows a stem or fine bore tube 1 attached to petal 2 or leaf having an end aperture 14 and a plurality of radial apertures 13 which are capable of discharging activating fluid or odiferous substance on the petal or leaf emanator 2. Apertures 13 may be omitted if not required, so relying upon discharge from end aperture 14.

Figure 8 shows an array of longitudinal dense fibres 15 protruding from the end of a stem or tube 1 for subsequent attachment or contact to e.g. a petal, leaf or bud. The fibres 15 may extend along the exterior surface as shown in Figure 9. These fibres would then take over transfer action of fluid/substance from the stem or tube.

In a further variation shown in Figures 10 and 11 the end aperture(s) 14 of a single or multiple fine bore tube (acting as or within the stem) may discharge the odour from the artificial plant without necessarily discharging fluid onto the petal or leaf.

To secure a petal or flower head arrangement onto a suitable stem e.g. to communicate with the stem interior whether the stem contains fibres and/or tubes or not, a fibrous plug may be used in the form of a nail shown in Figure 12. A head part 16 has a projecting body 15 optionally with protruding fibres 17 arranged to assist frictional fitting. A pair of close fitting washers 18 may be used to sandwich therebetween a flower petal arrangement such as subsequently described with reference to Figure 15. The washers may be of highly absorbent material e.g. compressed felt or fibres. As previously mentioned, the fibrous plug may be in the form of a nail and this may comprise previously degreased and hard packed fibres which may be bonded nylon and/or bonded polyester and/or bonded acrylic and/or bonded carbon fibres and/or extruded plastic or other material. The head or flat of the fibrous nail may be shaped and/or coloured so as to give the appearance of a flower part. Also these fibrous nails can be further modified as described and illustrated towards the end of the description where they may act as joining sections.

Potential use of the plug 15, which instead of being fibrous or in addition to being fibrous could be of capillary action material, is shown in Figure 13 where the nail body 15 is inserted into a stem or tube 1 or in Figure 14 where the stem or tube enters the nail. A plurality of tubes could enter a single fibrous plug. In Figure 15 the petal arrangement 2 has a central part 20 from which extends a plurality of radial slits 19 providing an openable and closable aperture. Alternatively, a small central hole could be deployed. Means are subsequently provided to connect the petal arrangement 2 to a stem or tube, for example the fibrous plug of Figure 12.

For embodiments using a plastic sheath or other coating around or within the stem interior, and assuming the stem interior was arranged at or near optimum density for capillary action, then if a fibrous plug is used to secure the petal or leaf emanators etc. the said sheath or coating should allow for subsequent expansion upon insertion and not interfere with capillary or other transfer mechanism by

throttling it. The petal or any other emanator may be constructed from polyester, silk or other fabric material.

The radial slits 19 are preferred as material around them can be forced into contact with the stem or tube by the action of the plug. Stem and emanator parts can be of the same material if required, cut to required shape and/or supplemented by other material useful as an emanator.

An external connector 19 supports petals 2 on stem 1 in Figure 16. The connector may be a plastic support and a fibrous plug (not shown) may be used on the interior. Alternatively or additionally, petals or leaves could be more self supporting by employing thick material or coating in a resinous or adhesive substrate for strength.

The stem may be or comprise irregular cross-sections as indicated in Figures 17 to 21. In the case of lengths of fibres or tubes, a bundle thereof 15 may be employed for capillary and/or absorption transfer as arranged in Figure 17, a plurality of hollow (5) fibres 15 having longitudinal slits and a central cavity 5a insert, through which a coloured liquid may flow, as in Figure 18 or closed semi-hollow fibres 15 with such cavity 5a as in Figure 19. Bi-component, concentrically oriented fibres could be used comprising inner and outer layers and the outer layer may be removable by e.g. heat. In such arrangements of irregular cross-section capillary action may be inhibited within the fibre and may be enhanced in compact vertical cavities between them.

Referring to Figures 20 and 21, the stem or its interior tube 1 may be hollow (5) and have a series of radial internal projections 6 of substantially increased surface area. Such stems or tubes may be produced by using known laser cutting methods.

The material of which the entire plant is made could be bio-degradable which may be useful in insect-controlling applications in agriculture and eliminate any need for collection and disposal. Examples of open-celled foams for inducing capillary action include phenol-formaldehyde or polyurethane foams. Instead of or in addition to using fibres for transfer of fluid or odoriferous substance one may use acetal or material known to be useful as the felt medium in felt-tip pens.

Examples of artificial plants constructed according to the invention are described below together with data from supplementary experimentation.

EXAMPLE 1

An artificial flower was produced which had microcapsules of fragrance placed on leaf, petal and stem areas. These were broken by various methods, rubbing, scratching, and pressure. This was carried out on either individual exterior surface areas and more than one area.

It was noticed that this allowed a controlled amount of fragrance to be released at required times for a long period of time.

EXAMPLE 2

The stem was filled with capillary tubing which allowed fragrance in a medium to travel up the inside of the stem and be released from either just the petals, or petals and leaves together or from these and other parts of the plant.

EXAMPLE 3

Carried out in similar fashion to Example 2 but the fragrance was already placed in or on parts of the plant and was released by a solvent e.g. an alcohol, which travelled up the stem by capillary action/adsorption/absorption/osmosis/reverse osmosis.

EXAMPLE 4

The stem was filled with or consisted of a hollow bore tube or tubes which allowed the fragrance to travel up the stem by capillary action or adsorption which was then released at various parts of the plant.

EXAMPLE 5

Carried out as Example 4 but using a hollow bored tube or tubes with an increased internal surface area (which was produced at the time of extrusion) which facilitated faster fluid movement.

EXAMPLE 6

The stem was filled with a wicking material, which in one case consisted of cellulose acetate fibres (which are resistant and inert to selected perfumes). The liquid in the liquid reservoir at the bottom of the plant either already contained fragrance or a solvent was used which caused fragrance already in the plant to be carried to areas where it could be released to the atmosphere.

EXAMPLE 7

Each of the above Examples were performed using a capillary flow of odoriferous substance comprising the following ingredients:

Ethanol	Perfume
Allantoin	Deionised—Distilled Water
Salicylic acid	

EXAMPLE 8

Carried out in similar fashion to Example 3, using solid fragrance which was put onto various exterior surface parts of the artificial flower. This was either already perfumed or the fragrance was initially inert and then activated by suitable activating liquid transferred according to any of the above examples.

EXAMPLE 9

A mixture of agar (alginate) and salt was formed around a central stem. The bottom of this stem was placed in liquid and slowly (over seven days) the liquid was seen to rise several inches up the coated stem by osmosis.

More relevant to the use of the exterior for liquid transport is the employment of certain powder-like materials which can be bonded together to allow capillary action to occur through the gaps. Experiments were carried out using water repellant adhesive Mowlith DHW (trade mark) from Harco Chemical Co. which glued vermiculite particles onto lengths of wire. The rise of liquid up these lengths was then monitored. Other adhesives were also tested e.g. from Vinyl Products Ltd. and National Adhesives Ltd. The vermiculite used was either in its crude form, or exfoliated, of various grades. It was possible to cause capillary action to occur. Some grades were found to induce better i.e. faster capillary action. The glue was mixed with water to see whether this improved matters.

Specifically the Vermiculite used was (Grades E199, E212, E230 and Micron) supplied by Mandoval Ltd., a division of R.T.Z. The adhesive was Mowlith DHW.

Vermiculite was tested as a wicking agent for artificial flower fragrance.

The feasibility of producing a vermiculite based coating capable of being used as a wicking agent for artificial flowers was evaluated.

EXAMPLE 10

Initially a 25% Mowlith DHW/75% water solution, by mass, was used as the adhesive in the following: The wire 'stem' was coated with adhesive and then rolled in the loose vermiculite. This produced an uneven, incomplete coverage, especially with the coarser E212 and Micron grades. After curing, the adhesion to the wire was found to be poor.

The wire 'stem' was coated with adhesive and rotated slowly whilst vermiculite was sprinkled over it producing a more even coverage. Again the E212 and Micron did not work as well. The final dried 'stem' did appear to have the vermiculite adhering to it more securely. The two above methods were repeated using the Mowlith DHW in differing concentrations—from 100% Mowlith down to 30% Mowlith and 70% water falling in steps of 10%.

Concentrations above 60% showed various degrees of sagging/running, but did produce very good adhesion between the wire and vermiculite. Adhesive concentrations below 50% did not allow such good adhesion between the wire and the vermiculite. This adhesive therefore appeared to give the best results, in both terms of coverage/appearance and adhesion, at concentrations of between 50% and 60%.

The finer grades of vermiculite, E199 and E230, overall produced a more uniform coating, but very thin. To gain the desired stem thickness (1—2 mm) the coating processes were repeated several times. The larger grades, E212 and Micron, built the coating thickness up better, but gave more uneven coating.

When the finished 'stems' were placed in a shallow dish with some water, the ones with finer vermiculite wicked much more quickly. Those of coarser grades were very slow, and in several cases water did not even reach the top of the 'stem' after 3 days or more.

During the test to see if the stems wicked, the adhesive was not seriously affected with regards to its hold on the vermiculite. However, when other adhesives were used instead of Mowlith DHW (i.e. those sold under the other trade marks Revacryl 602, Revacryl 313, Revacryl 491, Vantac 315, Vantac 294 and Vantac 506) the bonding that the adhesives produced was seriously reduced when water was present.

EXAMPLE 11

The final method tried was to mix the vermiculite and adhesive into a slurry. The following ingredients were used:

20.13 g Mowlith DHW
15.04 g Water
0.04 g Foamer
10.00 g Vermiculite

This produced a consistency in the slurry which allowed a uniform coating to adhere to the wire. After curing, a good, strong, even surface had been produced on the wire, but it prevented any wicking at all from occurring.

Separately it was found that when polymer acetate glues were tested, while they were resistant to water they were not resistant to ethanol, hence cross linking glues such as those based on butadiene-styrene copolymer have an advantage in their resistance to ethanol.

To improve capillary action the external area of fibre or internal area of tube may be of a valley and hills shape, generally shown in Figures 17, 20 or 21. The surface material could be absorbent-coated.

When exterior' transport is described the stem exterior may be formed from some or all of the materials

described for use in the interior. The exterior may be of wicking material and/or fine tubes and/or fibres.

When considering fibres and tubes generally the factors considered were: which density would provide the best capillary lift, yet would be least to be cut off should there be any absorption or adsorption occurring. The degree of absorption or adsorption is related to the individual solvent and fragrance; most commonly therefore the selection would depend upon the particular fragrances used in the solvents.

Cellulose acetate fibres or tubes are convenient in view of low cost. They have the disadvantage of being attacked by certain liquids (including many essential oils as used in fragrances) and adsorption can occur. Cellulose acetate because of its availability has been used in many of our experiments and examples presented herein.

Experiments have shown the following relationship between density and capillarity.

Density	Capillarity
0.3 $g.cm^{-3}$	17.5 cm W.G.
0.4 $g.cm^{-3}$	31.0 cm W.G.
0.47 $g.cm^{-3}$	42.0 cm W.G.

(W.G.=water gauge)

One way of increasing the density is to spirally twist or screw the fibres forcing them closer together. While this increases the overall distance which the liquid has to rise (due to the spiral screw effect), the liquid still achieved faster rise per unit height than untwisted fibre of 0.47 $g.cm^{-3}$. Thus the density could be higher than 0.47 $g.cm^{-3}$ and faster capillary draw may occur. The density at which this ceases to be true was not calculated because it is desired that there be slightly more space (less density) than the optimum, due to (i) possible adsorption cutting down space available and (ii) the effect of crinking of the outside sheath if the stem is bent. Density was worked out as follows:

$$\text{Density} = \frac{\text{Fibre Weight}}{\text{volume less wrap}}$$

$$\text{Volume (of fibre fill)} = \frac{\pi L(D-2T)^2}{4}$$

where

T=Thickness of wrap (wrap being the sheath/coating etc. enclosing the fibres)
L=Length
D=Overall diameter
π=Pye

Polyester fibres appear to have a lower capillarity, though inaccuracy in standardisation of manufactured samples has made this hard to confirm.

The density and type of fibres/tubes/etc. (the stem material) can be used in products where they need to be bent (e.g. in arranging artificial flower stems and bending to desired shape) without 'crinking' the stem in such a way as to inhibit capillary action.

One way of achieving this is to extrude the wire with the stem material. This is possible where e.g. cellulose acetate fibres are being used. If glass fine bore tubes are being used the stem is less flexible, but is more sturdy thus the wire support is not essential. If glass fibres are being used or fine bore tubes with increased internal surface area of an acetal material then wire support is advisable (dependant upon weight which stem must support, position of stem, and thickness of stem, i.e. a heavier set of emanating petals on top of a stem which is leaning at 45° will need a stronger stem support than one that has a lighter set of emanating petals and stands vertically, assuming similar relative bending strengths of the stem material) and absence of factors such as strong air flow.

Using samples we have shown that generally in decreasing susceptibility to bend are: fine bore glass tubes, fine bore acetal tubes, glass fibres, cellulose acetate fibres. However, these stem materials normally require to be kept in either plastic sheaths (especially the fibres in order to retain their density and prevent capillary seepage) or held together by other means. This sheathing or holding together can affect the strength of the stem but mostly does not provide (unless it is of a special shape maintaining material) the shape maintenance of a wire length. The wire length is normally inserted within the stem (i.e. inside the sheath with the fibres, if a sheath is present) for the aforementioned reason that this internal insertion helps prevent 'crinking' where capillary action is inhibited.

Rigidity of stem and ability of stem to hold positions once bent into those positions was possible by the addition of a wire along the stem. The most economical manufacturing method of doing this was to co-extrude the wire with a capillary tube if the capillary tube was being used, the capillary tube would for example contain cellulose acetate fibres and have a thin wall polypropylene plastic exterior, the wire would be inside the tube. Because the wire would probably be exposed to liquids then aluminium, copper,

stainless steel, hold an advantage as they are less likely to corrode. When cost is considered mild steel has an advantage, soft iron is flexible and holds position well and can be galvanized, a plastic coated iron wire may be used inside a tube of cellulose acetate fibres in a polypropylene sheath. However it may corrode at the ends of the plastic tube unless these are individually sealed.

Stainless steel when annealed is in the region of three times stronger than soft iron, therefore thinner steel wire can be used. A mixture of 12% chromium stainless steel (BS970, EN56A or EN58 (18:8) chromium steel) with a low carbon content suits the requirements of flexibility, maintenance of position, low corrosion potential and reasonable cost reasonably well. Commercially pure aluminium can corrode and build up bulky aluminium by-products, hence is not preferred. As there are a number of alternatives with various advantages, the major influencing factor is whether the above are used in a situation exposed to a fragrance, corrosion resistance to the individual fragrance, therefore selection of wire substrate may be made according to the particular items which may be added to the mix of solvent, fragrance base or activating liquid.

Integrated metal wire when in certain plastics may exhibit plastic deformity, with virtually no tendency to restore, to achieve this the ratio of wire strength to plastic strength can be corrected. The wire may be treated to impart greater flexibility e.g. by annealing.

The 'emanators' may be manufactured from a variety of materials, to perform their function they would preferably be of an absorbent material of low adsorption with a large surface area. Where cost, ease of manufacture, ability of material to be pressed and maintain shape (e.g. into the shape of a leaf, showing the central vein/stem of the leaf and where the two leaf sides are angled slightly together on the top side), ability to be dyed with permanent or non-permanent ink, (note: while use of non-permanent dyes may be useful for amusement or aesthetic benefit, they may lead to clogging or hardening of the emanators, and the permanent dyes used should maintain performance even after continued exposure to the liquid/fragrance), are the primary selection criteria, then polyester, silk, taffeta, pongee, satin or wood fibre or other fabric are preferred materials. The leaves and petals may for ease of manufacture be of the same material (even though only the petals may be used as emanators). Manufactured in a material such as polyester (alternative materials which have an emanating effect including taffeta, pongee, satin, silk, other fabric or wood fibre, mixtures of materials and materials in different layers, and would achieve the desired results may be employed), the leaves and petals may not require support over all their top and/or bottom surfaces. If a support is used therefor it may comprise a resinous coating or plastics material. Rather they may (dependant upon the size of the leaf/petal and thickness of material, i.e. a large thin leaf needs more support than a small thick leaf) need a small support from the stem.

The cross over of liquid from the stem to the emanator/s should facilitate effective passage across one to the other. There is preferably a large interface between the emanator and the stem, and that this interface will be where the two substrates are pushed tightly together. If both substrates are fibrous the gaps between the fibres of separate substrates should be small so that capillary action and/or absorption may continue. The effect of this interface may be enhanced using a fibrous plus as shown in Figure 12.

The absorbent material of these washers may be packed hard against the underside of the nail head or may be packed either side of the emanator. In this case the two respective washers 18 would be spaced apart.

In the case of items for consumer sale, they may need transport to a distribution warehouse, to retail outlet, to a consumer's home. In the case of the consumer sale, considerable time may elapse between construction of the artificial plant and ultimate use.

It is undesirable, in terms of waste, for the liquid or fragrance to be emitting from the point of manufacture. Furthermore, a vacuum or low pressure area is preferably prevented from forming in the reservoir because of the slow lowering of the liquid content through capillary action as this would inhibit capillary action. Also where a plant was exposed to strong sunlight or other sources of heat, vapour pressure may build up in the reservoir. One of the simplest methods of preventing the plant from activating normally and allowing evaporation from the emanator petals is to enclose it in a plastic bag which could lead to a high concentration of vapour existing in the bag which in turn should slow down the release of further fragrant odour.

The reservoir preferably contains a two-way air valve which prevents liquid from entering or escaping, an air permeable and water impermeable membrane may be used. Other methods of inhibiting unwanted odour release while in transit include: having a rubber bung or ringed rise on the base of the pot into which the stem fits initially when manufactured, the rubber bung or ringed rise would prevent entry of liquid into the bottom of the stem. The consumer may elevate the stem slightly to allow the liquid access. Alternatively, a layer of cling-film type material can be placed round the stem to separate it from the liquid when the stem would be a certain distance from the bottom of the reservoir, so that when the stem was pushed hard down it broke the cling-film and the liquid had access to it. Various alternatives are possible; ideally the stem should end up in a position so that enry into the stem is gained at the lowest level of liquid so that all the liquid may be used up. Any valve used should prevent the liquid from leaking as should all other items used or connected with the reservoir.

In other embodiments the bulbous head of a flower or leaf section or the stem itself may act as a reservoir, either of the liquid or of a concentrated form of the fragrance in liquid or solid form.

Certain modifications may be desired such as strengthening the stem to support the liquid/solid inside

it or in the leaf section of flower bud. If the liquid is stored very close to the area from which its fragrant odour is to be released, the vapour thereof may simply pass out through the walls of the flower petal which enclose it i.e. emanate through them and/or if in the case of a leaf bud, the leaf material may act as the emanator.

In embodiments of the invention which use a liquid reservoir which is sealed in the context that the contents are not directly exposed to the atmosphere, the liquid may be caused to move along/across the stem by applying an external force such as manually squeezing the said reservoir.

Within our experimentation we have evaluated solvents, acting as a solvent for the odoriferous substance or as an activating liquid, selecting those which have acceptable capillary lift.

Acetone had the advantage of being very volatile, probably too volatile for the fragrances used. Methyl Ethyl ketone worked well but has its own undesirable odour. Methyl Alcohol worked well but is poisonous. Chlorinated solvents can be abused and rendered toxic by smoking. Ethanol worked well but is highly flammable.

Water works reasonably well, does not wet out as much as ethanol/methyl alcohol/acetone etc., thus the capillary action is slower. The water should be deionised otherwise salts may be formed and certain perfume ingredients may be precipitated. Esters worked but typically had unattractive odour.

From the standpoint of safety, availability, cost and capillary action a mixture of water and ethanol has been most preferred.

Unless partitioning is the desired effect, components should be selected to avoid this. The liquid components used are preferably of a similar solubility, they should preferably not interact, lead to adsorption or separate over time. In terms of the liquid components it is possible to complex the items which would separate out, by using a complexing agent such as EDTA. The complex should be very soluble so that it does not precipitate and inhibit the capillary action.

Where fragrances are used these would typically be oils and therefore would not contain solids. Though they may need stabilisers if they are attacked by for example heat or sunlight, the ethanol and water mix when used should be used at a relative concentration whereby any additives are fully soluble. This point should allow for temperature changes. The water used is preferably deionised water. There is a wide range of relative mixtures of ethanol and water which were acceptable, the selection criteria would depend upon the end use. If one wanted to increase volatility one would increase the percentage of ethanol relative to water, to decrease flammability one would increase the percentage of water. To increase solubility of, for example, a fragrance in the mixture one would increase the percentage of ethanol relative to water.

In cases where the plants are to be exposed to the elements, or other harsh environmental affects, the emanators may be shaped to give best protection (i.e. in strong winds the leaves/petals are smaller than normal and/or the stem is stronger). The petals and/or leaves can be made from two different materials one only of which emanates and/or the material is coated in such a way so that only part emanates and the leaf/petal is shaped so as to protect that part from the hazard/s such as water flow or strong wind. Other harsh environmental factors may include sunlight or excessively warm temperatures. Excessively warm temperatures may have a damaging effect on the liquid e.g. if the liquid contained fragrance, the fragrance could be broken down by excessive heat and/or by variations in external temperature. To help prevent this damage the reservoir may be double walled (ideally though not necessarily with a vacuum in between) and/or coated in reflective silver material, and/or coated in polystyrene-type material, and/or made in a way so that if the reservoir is to be placed in a pot, it is formed when manufactured with the pot, or they are sealed together and the pot forms the second skin; and/or stabilisers/fixing chemicals may be used to stop the liquid being damaged.

If the surface area of the emanator/s is very very large relative to the cross-sectional area of the stem (where the capillary action draws the liquid from the reservoir, and delivers it to the emanators), then the majority of the exposed area of the emanator may dry out. If this is undesirable then the cross-sectional area of the stem effecting capillary action can be increased, or the area of the emanators responsible for emanation decreased. Influencing additional factors include the amount of capillary draw of the stem material and the emanator, and external vapour/air movement over the emanators. Assuming other factors (such as no high air pressure or low air pressure area in the reservoir etc) are absent or minimal relative to the afore-mentioned factors, then an equation for ensuring that the emanators are fully supplied with liquid is: Where there is one stem:

$$\frac{x \times y}{n \times a \times b} = 1$$

or where there is more than one stem:

$$\frac{m \times x \times y}{n \times a \times b} = 1$$

where:

m=number of stems
χ=stem
y=capillary draw of stem (quantity of liquid delivered per unit time)
n=no. of emanators
a=emanator
b=capillary draw of emanator (quantity of liquid emanated per unit time).

For example where there is 1 stem, of which the capillary draw is 0.30 cc per 6 hours there are 3 emanators, the emanation of each is 0.10 per 6 hours.

$$\frac{1\times 0.3}{3\times 0.1}=1$$

Alternatively:

$$b=\frac{\chi\times y}{n\times a}$$

and:

$$b=\frac{m\times\chi\times y}{n\times a}$$

Where there was one stem with a capillary draw of 0.6, two emanators of unknown emanation then:

$$b=\frac{1\times 0.6}{2}$$

∴ b must be equal 0.3 or less to be fully supplied with liquid. To achieve this, factors such as the emanator surface area may be increased or decreased. (Assuming there is no escape from the stem walls of liquid and that the emanators have become saturated with liquid to the degree at which they will be functioning.)

The liquid may be changed or refilled, the emanators may be substituted or increased/decreased as may the plant foliage. The stems may be substituted by new stems or increased/decreased. If a consumer fragrance product, the fragrance could be updated, so a fragrance of spring scents lead to summer scents, to autumn scents etc. The plants may have their colours changed.

Certain gaseous/semi-gaseous (e.g. freons)/highly volatile chemicals may be used in the reservoir. That is all the above may be performed, but where the liquid is substituted by gaseous/semi-gaseous/highly volatile chemicals. Where this was the case certain modifications could be made, such as any air-valve in the reservoir would need to be entry only, i.e. to allow ingressive air only and not vapour going out (unless for example as a safety requirement an out-going valve was needed), or there need be no valve. A highly volatile liquid will typically be affected by heat, and the proportion of liquid (relative to gas) rising up the stem and through the emanators will vary accordingly. This invention may also be used for containing a volatile solid, whereby again the capillaries of the stem and emanators would be used to allow the passage of vapour/gas. These alternative contents could be in a separate part of the reservoir to the liquid or used instead thereof, or placed in the same reservoir as the liquid; or added at the appropriate moment, this addition may lead to a chemical reaction and/or occurrence which is desired. The reservoir may be separated into two parts whereby they can be mixed together when, for example, there is only a low wall separating them into two parts whereby they can be mixed together. Mere mixing at the point of use may be the desired effect, alternatively there may be another or additional use, such as the production of a gas, which can either speed the rate at which liquid is forced out of the reservoir up the stem; or the gas is forced up the stem, or a mixture of gas/liquid vapour/liquid droplets is forced up the stem.

A combination of one or more of the above methods of transfer (and/or normal and/or reverse osmosis) may be employed whereby an artificial flower arrangement can be constructed embodying more than one of the basic techniques. It is preferred that the artificial flowers and/or reservoirs are refillable. It is also preferred to increase the shelf life of the artificial flower arrangement by incorporating an activating mechanism whereby commencement of fragrance discharge can be controlled by the user, the vendor, the installer or the like.

The advantages offered by the present invention include the provision of fragrance to artificial flowers, the provision of fragrance onto specific regions of the artificial flower to expel the fragrance into the surroundings, the conveying greater reality, the recognition and association of flowers and their characteristic scents by careful selection of liquid, solid or gaseous fragrances. Artificial flowers can be

constructed without requiring additional support beyond that which may be used at leaf to stem or petal to stem transfer junctions.

To improve capillary rise in any embodiment the fibre/s, tube/s or other material used preferably has low or no grease on the contact surfaces. By reducing the contact angle of the liquid against the surface of the substrate, capillary action may be aided. Generally this may be summarised as:

$$\text{Height of liquid rise from the free surface of the liquid in container (in centimetres)} = \frac{4 \times \text{surface tension} \times \text{contact angle}}{\text{density} \times \text{acceleration} \times \text{diameter of due to gravity capillary}}$$

In a small, vertical, open tube of circular section a column of liquid will stand at a height greater or less than that corresponding to the static head at the foot of the column by the amount.

$$H = \frac{4\sigma \cos \theta}{gD\ (p1-p2)} \text{cm}$$

Here σ is the surface tension, dynes/cm.; D is the diameter, cm; p1 and p2 are the densities, g./cc., of the liquid and gas (or light liquid), respectively; g=981 cm./sec.^{2}, approximately; and θ is the contact angle subtended by the heavier fluid. If it is desired to express H and D in inches, the units of the other quantities being unchanged, the factor 4 of the above formula should be replaced by 0.62. This formula is fairly accurate only if the tube is small enough for the meniscus to be substantially spherical.

To best achieve capillary rise the substrates selected should have a low grease content on their contact surface and/or should be manufactured to minimise the grease content. Alternatively the substrate can be de-greased, (e.g. soak capillaries in fresh chromic acid for 24 hours, wash in distilled water and deionised water then in dilute hydrochloric acid [where water used in dilution was distilled and deionised]). This will lower contact angle virtually to zero. An alternative way of increasing capillary rise is to increase the surface tension of the liquid, however, most methods of performing this have the effect of increasing density also. What is preferred is to increase the ratio of surface tension to density, not merely to increase surface tension; (note the ratio of surface tension to density is less for water than for ethanol).

Figure 22 shows a modified reservoir and stem arrangement based on a plurality of internal capillary tubes. A reservoir 6 in the form of a double-walled arrangement, or a single walled reservoir within an outer casing, contains odoriferous substance comprising fragrant liquid 7. The end 22 of the plant stem 1 is securely contained within a bore in a bung 21 conveniently of rubber. The sealing arrangement permits control of flow of liquid 7 in terms of 'on' and 'off' by raising or lowering the stem from the bore. With suitable modification it would be possible to control the rate of flow of liquid to the emanators.

Figure 23 shows an alternative stem arrangement for controlling flow of liquid or odoriferous substance. Within the reservoir 6 the stem 1 is positioned having an internal wire 23 secured at one end to bung 21 having sheath or covering 24. The wire can be raised to close the flow whereby the bung seals the end 22 of the stem, the sheath 24 partly enclosing the stem exterior, and lowered to commence and control rate of flow. Alternatively, the bung could be pierced to activate capillary flow.

A further alternative arrangement to control flow is to provide the end of the stem with an angled edge and cause this to be seated upon a correspondingly angled platform. The two end faces can sealingly engage in abutment and by twisting the stem relative to the platform a gap therebetween would be formed and so allow fluid or substance access to the stem for flow. Repositioning the stem would then close the flow.

In order to secure together two parts of a stem or two stem segments in a manner to provide fluid communication an arrangement such as shown in Figure 24 may be used. This shows a fibrous nail 15 (having no intermediate head) one end of which is embedded into an end 26 of the lower stem segment 1 and the other sharp end protruding, capable of being inserted into the facing end 26 of the upper stem segment 1. The embodiment includes a sheath 25 wrapped around the joint to help maintain the connection. The sheath may comprise plastic or rubber tubing for example. Such an arrangement shows a connection between two stem segments of identical or similar diameter. The method may be employed to connect together stem parts of different diameter as shown in Figure 25. This represents a cross-sectional view of a plant stem connected to smaller, subsidiary stems. In this drawing the larger, loose stem 1 has several subsidiary stems connected in liquid communication by means of fibrous plugs in the form of double-ended fibrous nails 15. Although at the actual junction between base to subsidiary stem a head 16 is provided, this is optional and may be omitted, using e.g. a form of plug as shown in Figure 24.

The fibrous plugs, in connecting together one stem (part) to another stem (part) assist in communication across the join and provide a means of location. Supporting sheaths may be used where possible.

CLAIMS

1. An artificial plant comprising a stem connected to one or more leaves and/or petals and having an

exterior surface part in communication or direct contact with means for supplying liquid, solid or gaseous odoriferous substance which can release its odour at the said part.

2. Plant as claimed in claim 1, wherein the part is in direct contact with liquid or solid odoriferous substance whereby its odour is or can be arranged to be released at the point of contact.

3. Plant as claimed in claim 1 or 2, wherein a stem, leaf or flower part is in contact with encapsulated supply means capable of subsequent odour release and/or in contact with non-odour releasing substance capable of subsequent odour release by the action of an activating fluid.

4. Plant as claimed in claim 1 or 3, wherein the stem is in communication with a reservoir which can supply odoriferous substance or an activating fluid to the stem and/or the stem interior and/or the stem exterior and/or other exterior surface part or parts of the plant.

5. Plant as claimed in claim 4, wherein the stem comprises wholly or partly liquid-absorbent material or is provided with an internal or external wick of absorbent material.

6. Plant as claimed in claim 5, wherein the absorbent material comprises open-celled natural or synthetic foam or fibrous material.

7. Plant as claimed in any one of claims 4 to 6, in which the stem is hollow with or without at least one internal hollow tube.

8. Plant as claimed in any one of claims 4 to 7, including junction(s) between the stem and a leaf and/or between the stem and a flower which junction(s) is (are) of liquid absorbent or capillary action material is contact with such material, when present, on or in the stem.

9. Plant as claimed in any one of claims 4 to 8, in which the reservoir is sealed and capable of supplying odoriferous substance or an activating liquid to the stem by application of an external force or gravity.

10. Plant as claimed in any one of claims 7 to 9, in which the stem or hollow tube(s) have an irregular cross-section and/or inwardly directed protrusions increasing internal surface area.

11. Plant as claimed in any preceding claim, including an external wick secured thereto and bonded with particulate matter capable of transferring odoriferous substance or activating liquid.

12. Plant as claimed in any one of claims 6 to 11 in which the stem is provided with spirally twisted, compacted fibres optionally contained within an outer sheath.

13. Plant as claimed in any preceding claim, including wire reinforcement internally or externally of the stem optionally contained within an outer sheath.

14. Plant as claimed in any preceding claim, in combination with activating liquid or solvent for odoriferous substance comprising a mixture of ethanol and deionised water.

15. Plant as claimed in claim 14 in which the mixture contains 15 to 85% of water, preferably 55 to 85% of water based on the weight (or volume) of the composition.

16. Plant as claimed in any one of claims 4 to 15, wherein the reservoir contains odoriferous substance and a stabiliser to retard decomposition thereof.

17. Plant as claimed in any one of claims 4 to 16 in which the reservoir or plant is provided with means to initiate and/or control and/or terminate flow of odoriferous substance or activating fluid to or along the plant stem.

18. Plant as claimed in any preceding claim incorporating non-fibrous material, such as acetal, for capillary flow of substance or fluid.

19. Plant as claimed in any preceding claim incorporating a fibrous plug securing together a leaf or petal to a stem and/or securing two adjacent stem parts together.

20. Plant as claimed in Claim 19 in which the fibrous plug is shaped or coloured to form a visible component.

21. Plant as claimed in claim 19 or 20 in which the fibrous plug incorporates washers of absorbent material.

22. Plant as claimed in any preceding claim in which a leaf or petal or the total leaves or petals are supported solely by the stem part bearing it or them whereby other supporting means therefor are absent.

23. Plant as claimed in any one of claims 1 to 21 in which any support means for a leaf or petal or the total leaves or petals occupies an area of 10% or less than the area of the particular leaf or petal supported.

24. Plant as claimed in any one of claims 4 to 23 in which the material on, of or within the stem for capillary flow is substantially free of grease or has been subjected to degreasing prior to installation.

Printed for Her Majesty's Stationery Office by Courier Press, Leamington Spa, 4/1987. Demand No. 8991685.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.